

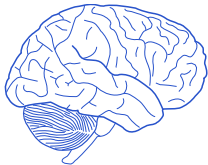
# Consistency in Collaborative System Engineering

## Sources, Resolution proposition & Illustration

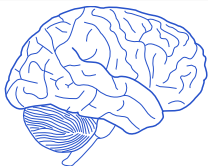
Ali Koudri

April 4, 2018

# From Engineering to Collaborative Engineering



# From Engineering to Collaborative Engineering

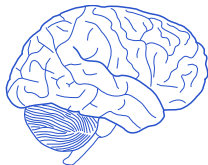


- Perception



- Sensor

# From Engineering to Collaborative Engineering

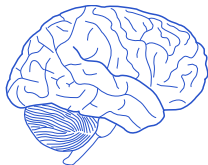


- Perception
- Representation



- Sensor
- Data

# From Engineering to Collaborative Engineering

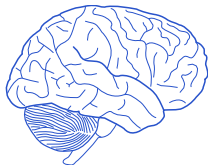


- Perception
- Representation
- Information Processing



- Sensor
- Data
- Computation

# From Engineering to Collaborative Engineering

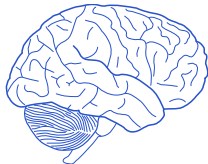


- Perception
- Representation
- Information Processing
- Knowledge



- Sensor
- Data
- Computation
- Documents, Ontologies

# From Engineering to Collaborative Engineering

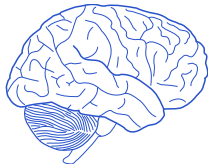


- Perception
- Representation
- Information Processing
- Knowledge
- Beliefs / Emotion



- Sensor
- Data
- Computation
- Documents, Ontologies
- ?

# From Engineering to Collaborative Engineering



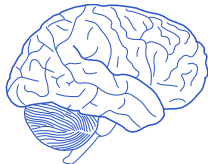
- Perception
- Representation
- Information Processing
- Knowledge
- Beliefs / Emotion
- Reasoning



- Sensor
- Data
- Computation
- Documents, Ontologies
- ?
- Boolean logic



# From Engineering to Collaborative Engineering

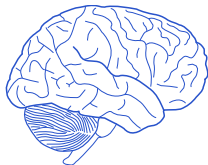


- Perception
- Representation
- Information Processing
- Knowledge
- Beliefs / Emotion
- Reasoning
- Creativity



- Sensor
- Data
- Computation
- Documents, Ontologies
- ?
- Boolean logic
- ?

# From Engineering to Collaborative Engineering

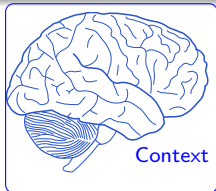


- Perception
- Representation
- Information Processing
- Knowledge
- Beliefs / Emotion
- Reasoning
- Creativity
- Action / Reaction



- Sensor
- Data
- Computation
- Documents, Ontologies
- ?
- Boolean logic
- ?
- Actuator

## From Engineering to Collaborative Engineering

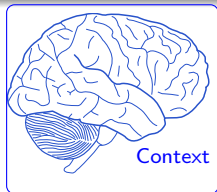


- Perception
- Representation
- Information Processing
- Knowledge
- Beliefs / Emotion
- Reasoning
- Creativity
- Action / Reaction
- Context



- Sensor
- Data
- Computation
- Documents, Ontologies
- ?
- Boolean logic
- ?
- Actuator
- ?

## From Engineering to Collaborative Engineering

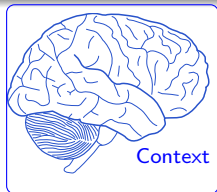


- Perception
- Representation
- Information Processing
- Knowledge
- Beliefs / Emotion
- Reasoning
- Creativity
- Action / Reaction
- Context

- Tools
- Languages
- Compilers
- Frameworks

- Sensor
- Data
- Computation
- Documents, Ontologies
- ?
- Boolean logic
- ?
- Actuator
- ?

## From Engineering to Collaborative Engineering



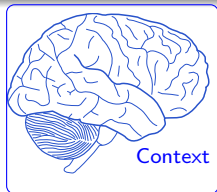
- Perception
- Representation
- Information Processing
- Knowledge
- Beliefs / Emotion
- Reasoning
- Creativity
- Action / Reaction
- Context

not so limited, confusing

- Tools
- Languages
- Compilers
- Frameworks

- Sensor
- Data
- Computation
- Documents, Ontologies
- ?
- Boolean logic
- ?
- Actuator
- ?

## From Engineering to Collaborative Engineering



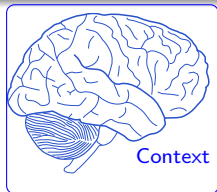
- Perception
- Representation
- Information Processing
- Knowledge
- Beliefs / Emotion
- Reasoning
- Creativity
- Action / Reaction
- Context

- Tools
- Languages
- Compilers
- Frameworks

limited, imprecise, organized

- Sensor
- Data
- Computation
- Documents, Ontologies
- ?
- Boolean logic
- ?
- Actuator
- ?

## From Engineering to Collaborative Engineering



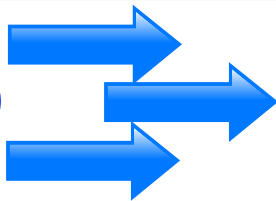
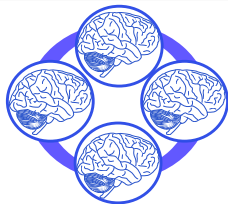
- Perception
- Representation
- Information Processing
- Knowledge
- Beliefs / Emotion
- Reasoning
- Creativity
- Action / Reaction
- Context

- Tools
- Languages
- Compilers
- Frameworks

projection issues, not fully consistent

- Sensor
- Data
- Computation
- Documents, Ontologies
- ?
- Boolean logic
- ?
- Actuator
- ?

## From Engineering to Collaborative Engineering



- Perception
- Representation
- Information Processing
- Knowledge
- Beliefs / Emotion
- Reasoning
- Creativity
- Action / Reaction
- Context

- Tools
- Languages
- Compilers
- Frameworks
- More humans
- More tools
- More computers
- More interactions
- **More iterations**
- **More inconsistencies**

- Sensor
- Data
- Computation
- Documents, Ontologies
- ?
- Boolean logic
- ?
- Actuator
- ?



## System Engineering Considerations

Conception of complex systems requires a consistent methodology taking into account several considerations:

- Organization: **Who** is concerned ? How people are related to each other ?
- Business: **What** is the purpose of the system ?
- Technique: **How** the system will realize what is expected from it ?
- Technology: **With what** the system will be implemented ?
- Context: **Which** constraints (environmental, legal, . . . ) the system shall be in line with ?

Each of those considerations has several aspects

- Ontological: knowledge representation, what do we know (believe) about those considerations ?
- Linguistic: gathers semiotic and semantic aspects to represent knowledge and new hypotheses
- Logical: underlying reasoning rules for consistency checking and inference
- Paradigmatic: computations, explorations and decision making (change management)

## System Engineering Considerations

The intersection between considerations and aspects represents a viewpoint, and can be represented by the following matrix

	Organization	Business	Technique	Technology	Context
Ontological					
Linguistic					
Logical					
Paradigmatic					

- Each expert manages its own viewpoints
- He/She manages its own knowledge about the different concerns
- He/She uses its own symbols to make a representation of those concerns, with its own semantics
- He/She manages its own rules for reasoning and inference
- He/She uses its own paradigms to assess new hypotheses and to manage changes